

PERCUTANEOUS POSTERIOR SPINAL FUSION IMPLANT CONSTRUCTION AND METHOD

BACKGROUND OF THE INVENTION

The present invention relates to the percutaneous insertion of spinal fusion implants into the body of a patient and the affixation of those implants to the spine. In particular, the invention includes percutaneous posterior spinal fusion systems, devices used in conjunction with such systems, and associated methods.

Pedicle screw fixation constructs have been in use for decades in order to fuse adjacent vertebral segments to improve spinal stability or correct certain spinal deformities. Older approaches for inserting these fixation constructs involved open procedures, in which relatively large skin incisions were created to expose a substantial portion of the patient's spinal column, in order to allow for insertion of the pedicle screws and manipulation of spinal rods through openings adjacent to the heads of the screws.

Over time, less invasive approaches have been developed. Typically, in such approaches, pedicle screws are inserted into the pedicles of the same or adjacent vertebrae of a patient's spine through individual percutaneous incisions corresponding to the pedicle screws. Fixation or fusion rods are then inserted into the body through one of those incisions, or through an additional incision adjacent to the most cephalad or caudal pedicle screw, and the rod is rigidly connected to the pedicle screws such that the rod extends along the longitudinal axis of the spine (i.e., along the cephalad/caudal direction) in order to fix the relative positions of the adjacent vertebrae to which the rod is connected. In some such minimally invasive procedures, a device (e.g., a cannula, tower, or portal) is connected to each of the pedicle screws and extends through the respective percutaneous incision. Moreover, it is known to utilize separate elongate blades connected with the screws. Such devices provide a percutaneous passageway through the tissue from each incision to the respective pedicle screw, in order to aid in the insertion of a spinal rod. Examples of such passageway devices are described in commonly-assigned U.S. Pat. No. 7,955,355 ("the '355 Patent") and U.S. Pat. No. 8,002,798 ("the '798 Patent"), the entireties of which are hereby incorporated by reference herein as if fully set forth herein.

Although considerable effort has been devoted in the art to optimization of such minimally invasive systems, still further improvement would be desirable.

BRIEF SUMMARY OF THE INVENTION

One aspect of the present invention provides a system for manipulating portions of a spinal fusion system. The system according to this aspect of the invention desirably includes a connecting element, a passageway device, and a tubular member. The connecting element is preferably attachable to a vertebra of the spine, and a distal end of the passageway device is preferably connected to the connecting element. The tubular member preferably has an opening through its sidewall between its proximal and distal ends, and the tubular member is preferably removably positionable over the passageway device in an inserted position. In that position, an open interior portion of the tubular member preferably receives the passageway device within it.

According to another aspect of the invention, the tubular member may be structured such that, when it is positioned in the inserted position, its distal end is positioned proximate the

connecting element and a feature of the passageway device is positioned adjacent to the opening. According to a further aspect of the invention, the feature may be the proximal end of the passageway device. According to yet another aspect of the invention, the sidewall of the tubular member may include a visible marking proximate the opening. In accordance with a further aspect of the invention, the visible marking may be indicative of a length of the passageway device. According to another aspect of the invention, the tubular member may include a second opening through its sidewall between the proximal and distal ends.

According to other aspects of the invention, the tubular member may be a counter torque tube having a handle projecting laterally therefrom. According to a further aspect of the invention, the distal end of the tubular member may be structured to engage the connecting element in the inserted position so as to prevent relative rotation between the connecting element and the tubular member.

According to another aspect of the invention, the system may further include a second connecting element, a second passageway device, and a second tubular member. The second connecting element is preferably attachable to a second vertebra of the spine, and a distal end of the second passageway device is preferably connected to the second connecting element. The second tubular member is desirably removably positionable over the second passageway device in a second inserted position. In that position, a second open interior portion of the tubular member preferably receives the second passageway device within it. The second tubular member may be movably connectable to the tubular member to allow for compression and distraction of the first and second vertebrae.

According to yet another aspect of the invention, the passageway device may include a first blade having a distal end connected to the connecting element, and the open interior portion of the tubular member may receive the first blade in the inserted position. In accordance with a further aspect of the invention, the open interior portion of the tubular member may include a first channel that receives the first blade when the tubular member is positioned in the inserted position. According to another aspect of the invention, the passageway device may include a second blade having a distal end connected to the connecting element, and the open interior portion of the tubular member may receive the second blade in the inserted position. In accordance with a further aspect of the invention, the open interior portion of the tubular member may include first and second channels that receive the respective first and second blades when the tubular member is positioned in the inserted position.

Another aspect of the present invention that provides a system for manipulating portions of a spinal fusion system desirably includes a connecting element attachable to a vertebra of the spine; a tubular member; and first and second blades, each of which has a distal end connected to the connecting element. The tubular member preferably has first and second channels formed therein that receive the respective first and second blades when the tubular member is positioned in an inserted position in which its distal end is proximate the connecting element.

According to yet another aspect of the invention, the system desirably further includes a second connecting element attachable to a second vertebra of the spine; a second tubular member; and third and fourth blades, each of which has a distal end connected to the second connecting element. The second tubular member preferably has third and fourth channels formed therein that receive the respective third and fourth blades when the second tubular member is positioned in a